The Tech Engineering News

Volume 1 No. 1 CAMBRIDGE, MASS., FEBRUARY, 1920 Price 10 Cents

AN AMERICAN SOURCE OF ORGANIC CHEMICALS FOR RESEARCH.*

As is now well known, the widespread German chemical industry has its foundation rooted in the research carried on in organic chemistry in the German universities and in the technical industrial laboratories. An important factor in this research, a factor which has perhaps been somewhat overlooked in discussions of the matter, was the ready supply of organic chemicals available in the German market. When a German research chemist required a synthetic product, it could usually be obtained from the market without difficulty; and even substances for which the demand was extremely small and of which the use was entirely confined to the research laboratory could in many cases be obtained in reasonable quantities on demand. There were two firms in Germany who specialized in the supply of these organic chemicals, their source being the intermediates produced by the dye works and other organic chemical industries.

Organic chemistry, in fact, is dependent for its progress upon a circle of production involving not only the chemical works but the university and technical laboratories. These laboratories produce new chemical theories and new chemical synthesis as the result of their research work. The factories adopt these synthesis in the form of new processes and from them produce new chemical products which are placed upon the market, but a small portion of the intermediate and finished products so obtained must be turned back to the laboratories for use in future synthesis.

Before they can be utilized by the laboratories, however, these products require purification, and in many cases it is necessary to prepare research chemicals from materials which are not directly produced by the works. The laboratories thus require a supply of pure chemicals, and in the diagram this is indicated by the division entitled "Synthetic Organic Chemicals," the supply of which is essential to the continuance of the life of the laboratories, which in their turn are essential to the well-being of the industries.

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*Prepared expressly for THE TECH ENGINEERING NEWS by the Eastman Kodak Co.

THE RACE FOR INDUSTRIAL SUPREMACY.
"Kick him out of the way, Sam."

AN OPEN LETTER TO THE ALUMNI

This issue of THE TECH ENGINEERING NEWS reaches three thousand of the Alumni. Succeeding issues will undoubtably reach a much larger proportion.

To you among the Alumni who have an interest in the welfare of Tech men, graduates or undergraduates, this appeal is addressed.

If you encounter anything which it would be well for Tech men to know, tell us about it.

If you discover a better way of doing something Tech men are doing, or an opportunity of which Tech men might take advantage, send us a brief account of it.

A few words are all that is needed; just sit down, when you think of it, and write an intimate personal account which will reach friends and acquaintances throughout the country.

Thus THE TECH ENGINEERING NEWS may prove a further bond between Tech men everywhere.

Yours truly,

C B Tapp

General Manager

PAPER FROM BAGASSE.

By CLARENCE J. WEST
of ARTHUR D. LITTLE, Inc.

The utilization of sugar cane refuse or bagasse as a raw material for paper making was first suggested many years ago, but it is only recently that the operation has been made commercially successful. The failure has been caused in part because of the bulky nature of bagasse and the low yields of pulp obtained from it, and in part because the pulp was converted into a quality of paper to which it inherently was ill adapted.

Paper making involves two distinct operations; the first is largely chemical in nature and relates to the conversion of the raw material into pulp; the second is almost entirely mechanical and is concerned with the conversion of the pulp into paper.

The processes in general use for producing chemical pulp may be divided into two broad classes,—acid and alkaline processes.

The only acid process which has ever come into successful use for pulp making is commercially known as the sulfite process. This consists in digesting the raw material in large autoclaves or digesters with a liquor consisting of calcium bisulfite or a mixture of calcium and magnesium bisulfite, held in solution by an excess of sulfur dioxide. The temperature usually reaches a maximum of 10° C and the pressure does not exceed 70-75 pounds. The duration of the digestion is usually about 9 to 10 hours.

The alkaline process for digesting raw material is much older. The cheapest method consists in the use of slaked lime in amounts from 10 to 15% by weight of the raw material taken. Pressures of 25 to 50 pounds are maintained and the cooking period lasts from 4 to 8 hours.

The more common practice consists in the use of caustic soda or a mixture of milk of lime and soda ash. The amount of caustic soda used depends entirely upon the class of material and may vary from 10 to 30% of the dry weight of the material taken. The time of cooking also varies from 2 to 8 hours, while the pressure may vary from 40 to 100 pounds per square inch. About 85% of the soda used is recovered by evaporation and incineration to black ash, which

(*Continued on page two*)

ECKART PROCESS FOUR WEEKS AFTER LAYING

THE TECHNOLOGY PLAN

Before entering on any important undertaking it is desirable for an industrial concern to know "the state of the art," that is, to go fully into the literature of the subject, and to find out what other people have done along similar lines. The second step is to lay out the procedure for the enterprise and devise the best means and processes to accomplish the result.

Although this kind of knowledge is the very foundation of our industrial edifice, it has heretofore been very difficult to get, as each concern was obliged to make a separate search, and this has undoubtedly stood in the way of much industrial advancement.

With the appointment of Doctor William H. Walker as director of the new division of Industrial Cooperation and Research of the Institute of Technology, the Institute has founded a clearing house for industrial knowledge, which, when fully organized, will be able to give information on the status of industrial problems, outline procedure for carrying out undertakings, and be prepared to suggest specialists in various lines, who are fitted for the proposed work. In some cases the facilities of the Institute itself will be necessary, while in others the client will be directed to government laboratories, to other technical institutions or to private concerns here or abroad.

It is understood that the Division of Industrial Cooperation and Research will still continue its interest in the development of the plans upon which it has made suggestions, and in securing the best results.

This division will also afford facilities of securing personnel for special work along the varied lines required by industry.

The division of industrial Co-operation and Research is distinct and separate from the educational side of the Institute, but it cooperates with it in that considerable of the work will necessarily be done in the Institute laboratories, which will in turn develop in proportion to the demands upon them.

President Maclaurin has stated that this is "perhaps the most important step the Institute has taken since its organization." Its potential influence on productive America cannot be calculated.

Paper from Bagasse.

(*Continued from page one*)

is causticized with burnt lime in the usual way.

A third process is the so-called sulfate process. In this a mixture of soda ash and salt cake (sodium sulfate) is used. In the recovery process, the sulfate is largely converted into sulfide, so that the actual cooking liquor is principally caustic soda and sodium sulfide. Its action is considerably less drastic than caustic soda alone, and the results are a slightly increased yield and better bleaching qualities of the pulp. The process has one rather serious disadvantage in that it is attended with a most persistent, penetrating, disagreeable odor, due to organic sulfur compounds. While the odors are not toxic, they are of such a disagreeable nature as to cause the utilization of the process to be limited to sparsely settled communities.

Either the soda or sulfate process may be applied to the cooking of bagasse.

The second operation, the conversion of the pulp into paper, is largely mechanical in nature. The pulp is further mechanically disintegrated in the beater, is diluted with about 100 times its weight of water and passed on to a travelling wire mesh screen, which allows the water to pass through, but retains the fiber in a fibrous sheet in which the fibers are crossed and felted with one another. This sheet is successively pressed and finally passed over steam heated cylinders to remove the water which cannot be pressed out.

Bagasse as it comes from the sugar mill is not suited for pulp-making on account of the high content of non-fibrous cellular tissue or pith, which in itself has no value in paper making. This pith may be removed by shredding the bagasse and then sifting in a rotary screen. One hundred pounds of air dried material will yield 30 pounds of screened bleached pulp. This is calculated to cost about $4.85 per ton of bleached pulp, and is much cheaper than pulp from wood.

The pulp thus obtained may be utilized in the preparation of book paper, or writing papers. It will probably find its greatest application in admixture with rag, sulfite or soda fibers for the production of book and the cheaper grade writing papers. Bagasse has little value as wrapping and other papers where strength is the principal consideration.

From experimental runs made in the paper mill of Arthur D. Little, Inc., it was concluded that the sulfate process could be satisfactorily used with bagasse. The most suitable composition of the cooking liquor was found to con-

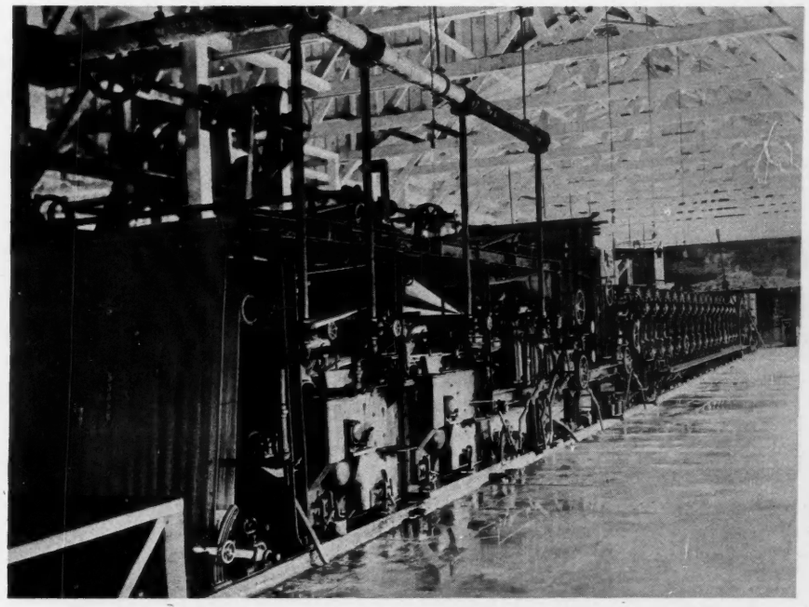
(*Continued on page three*)

Paper From Bagasse.

(*Continued from page two*)

sist of 15% caustic soda and 7.5% sodium sulfide. About 3 parts of cooking liquor to one of the bone dry fiber gives the most satisfactory yield. While a slightly higher yield would be obtained by increasing the ratio to 4:1, the increase in steam required would probably not compensate for the higher yield. The time of cooking is five hours at 100 pounds pressure or eight hours at 75 pounds pressure. If on the other hand the soda process is used, a liquor with 25% caustic soda should be used for a period of 5 hours at a pressure of 100 pounds per square inch.

Bagasse paper is of particular interest in these times because of its application to the Eckart process. The process (known as the Eckart process from its discoverer) is peculiarly adapted to the Hawaiian Islands because of their volcanic origin. The soil is only about six inches deep and is very porous. The fertilizer, of which large quantities are needed, tends to wash away with the heavy rainfall, characteristic of tropical climates. A method which would avoid this would materially increase the yield of the sugar cane. A second factor is the rapid growth of weeds and the difficulty of cultivation. The importance of this factor is seen when it is stated that in one district alone nearly one million dollars are spent annually for cultivation. One method suggested to destroy the weeds consists in spraying a solution of white arsenic in soda ash. The advantage of this method is that the weeds have to be hoed out of the cane rows and placed in the center spaces and then sprayed with the arsenic solution.



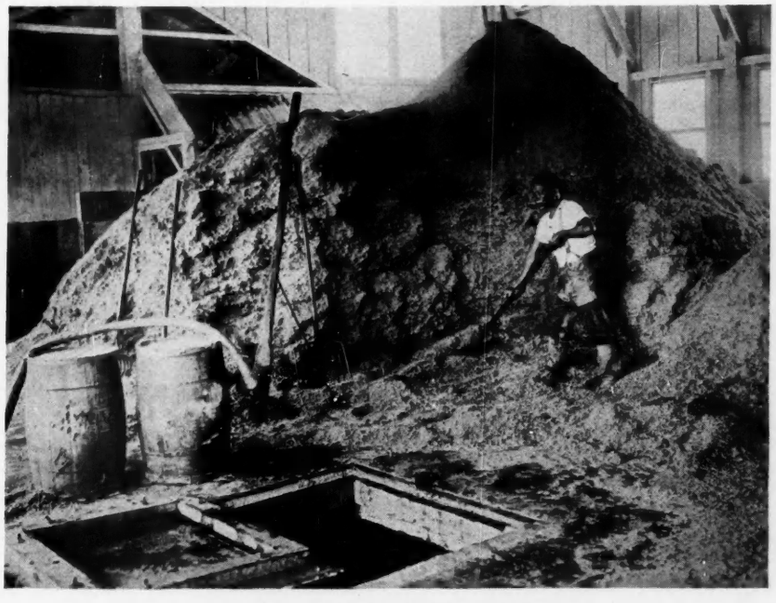
GENERAL VIEW OF PAPER MACHINE

The new method, now in successful operation in the Olaa district of Hawaii, consists in laying an asphalt paper, about a yard wide, longitudinally over the rows. The young shoots of the sugar cane are stiff and sharp, so that under favorable conditions they penetrate the paper. The weeds, on the other hand, lack this quality and their sprouts are smothered. Owing to irregularities in the ground, some of the shoots strike the paper and buckle under. These show their presence by little elevations in the paper. At this point laborers pass between the rows and with long knives make longitudinal slits in the paper on the humps. This is rapidly and cheaply done and the cane heretofore covered emerges and grows. The growth of weeds between the rows beyond the edges of the paper is readily controlled by spraying.

This method avoids weeding and accomplishes the following things: Moisture enters the earth between the edges of the paper and seeps through. The earth is not dried out by the sun, and further, the fertilizer is protected from the direct rainfall and is thus utilized by the cane before it is leached out of the ground. The dark paper absorbs the heat and imparts it to the soil underneath, raising the temperature from 3 to 5 degrees Fahrenheit.

In the early experiments asphalt building paper of a certain weight was used, but it was not particularly suited for this purpose. It seemed desirable to prepare a paper especially for this work, and, if possible, utilize waste material from the plantations. Such material was found in bagasse. The problem was to prepare a special quality of paper, strong enough to withstand Hawaiian rainfall, and yet which could give way under the constant gentle pressure of the cane. It had to be dark in color and the cheaper the better.

In practice, according to Chas. W. Mason, superintendent of the Olaa Mill, the bagasse is cooked for twelve hours with lime under 60 pounds pressure. It is allowed to remain on the floor for three or four days before being used. It is said that this exposure to the air causes the paper to work better on the paper machine. It also renders it easier to saturate the paper with asphalt. The rolls are allowed to stand 24 hours to give a chance for the asphalt to soak in.



BAGASSE LOFT OF A PAPER MILL

The Tech Engineering News

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Advertising rates on application.

The publication of this issue of THE TECH ENGINEERING NEWS gives the editors the opportunity and the pleasure of thanking the many friends who have given their support to make this paper a success. Assistance, without which this paper could not have been started, has been given generously and unhesitatingly, and we regret that we can do no more than assure our friends of our lasting gratitude and our sincere appreciation.

We believe it to be the custom in starting a new publication, to state the plans and purposes of the newcomer. However, as THE TECH ENGINEERING NEWS is an enterprise so totally different from anything which, so far as we can discover, has been tried before, we feel that it would be a better policy to refrain from stating our objects until the needs of the situation can be more accurately determined. We shall therefore content ourselves with saying that it is our ambition to furnish the Alumni and undergraduates with the best possible professional journal, and that we hope that THE TECH ENGINEERING NEWS may be the means of closer co-operation between the Institute and its graduates.

Our readers are urged to bear in mind our difficulties in starting, and to realize that the first issue cannot very well be more than an indication of what THE TECH ENGINEERING NEWS may become.

Whatever that result is will depend upon the co-operation of our readers, Alumni and undergraduates. THE TECH ENGINEERING NEWS cannot be more than a medium for the exchange of their ideas. Its editors will do all in their power to make the organ a worthy one.

To that end Alumni and undergraduates alike are urged to make contributions on subjects which will have professional interest for their fellows.

Articles on a number of dissimilar subjects will be found in this issue. It is hoped that students of a particular course will not confine themselves to reading articles concerning that course. One of the factors which resulted in the conception of THE TECH ENGINEERING NEWS was the need for some medium to inform students of other professions than their own. Therefore, it is hoped that Mechanical Engineers will read articles such as that by Dr. Clarence West on the chemistry of paper making, and that Chemical Engineers will read articles on boiler and turbo-generator construction. It cannot be foreseen what situations a man may meet after graduation, and a fund of general information is not a bad thing to have.

On the first page of this issue we publish an article by the Eastman Kodak Co., which should command interest, as it contains information regarding further patriotic activities of Mr. George Eastman, the Institute's generous benefactor.

While conducting the work necessary to the starting of this paper, we were asked if we should not be competing with professional and trade journals. An effective answer to this question is found in the cordial co-operation a large number of such journals have offered us. THE TECH ENGINEERING NEWS will not compete with older publications to any greater extent than THE TECH competes with the daily newspapers. Each one covers a separate field. We are glad to assist our readers in making use of the current numbers of professional journals by publishing on another page a list of articles the editors have found interesting and instructive. We hope to have the assistance of the heads of the various courses in making up this list for later issues.

A call for candidates for THE TECH ENGINEERING NEWS will be made in THE TECH at a near date. The number working on the paper now is very limited, a large staff will be needed, and places will undoubtedly be found for all who will be willing to work for the paper.

Complimentary copies of the first issue will be mailed promptly to anyone for whom they may be requested. All that is necessary is to mail a card to Circulation Manager, THE TECH ENGINEERING NEWS, Cambridge, giving the name and address of the person or persons for whom copies are requested.

THE TECH ENGINEERING NEWS is not a successor to, and has no connection with either THE TECHNOLOGY MONTHLY, THE SCIENCE CONSPECTUS, or THE TECHNOLOGY REVIEW.

Licensing Engineers

In another column mention is made of recent legislation in Oregon, which requires engineers to pass an examination before they may be allowed to practice within the state. Similar legislation has been passed in the states of Michigan and Idaho within the year. It is probable that many other states are considering the matter, and if there is no change in the situation, we may see within a short time, as many different state laws, and as conflicting in their requirements, as has been the case in regard to other matters of the same nature.

When we take up the question of registering or licensing engineers we have two very different precedents within the professional class. Doctors are permitted to practice after having successfully passed examinations given by the state. Lawyers, on the other hand are, in most states, examined and qualified by a board of bar examiners; members of their profession are the only ones to say whether or not a candidate shall be admitted to the bar. State and national bar associations, similar in their objects and functions to our large engineering societies, assist in directing this work.

The natural question to ask when the matter of licensing engineers is pressed is, which precedent shall we follow. In Michigan, Idaho and Oregon the question has already been decided. Legislators with limited knowledge of engineering are dictating tests to be applied to every engineer in their respective states. Meanwhile, so far as we know, no action has been taken by those best qualified to make the necessary provisions, and who are to be most vitally affected by the result.

It may be argued that members of the various engineering associations are opposed to the policy of examining applicants for the title of engineer. However, it would seem that whatever their

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Licensing Engineers

(*Continued from page four*)

wishes, the possibility is fast becoming a fact, and that at the hands of bodies far worse qualified for the task than the engineering societies, many of whom already conduct thorough examinations into the qualifications of their members before admitting them to membership. A further consideration which should have weight in pressing for action on this matter, is the need for uniformity in the method of examination throughout the country, something which could only come through the agency of a national association.

Modern Methods of Dealing With Labor.

Business men throughout the world realize that there must be basic changes in the treatment of labor, and are seeking the best means by which these changes may be brought about. Old questions, such as that of the right of workers to share profits or to exercise a measure of control over the concerns for which they labor are being pressed with an insistence never believed possible, and new questions come to the front every hour. Magazines, newspapers, trade journals, and even professional journals are discussing the matter and seeking to find its solution. For these reasons we should pay great attention to the words of one who has had such marked success in dealing with labor as has been the part of Mr. Endicott.

Mr. Endicott, who is the senior member of the firm of Endicott, Johnson & Co., large shoe manufacturers, has acquired distinction as a result of his remarkable success in dealing with industrial problems, and his services to the State during the war. His effective work as Executive Manager of the Massachusetts Committee of Public Safety, as well as National and State Food Administrator for Massachusetts exemplify the ability as a business organizer which has characterized all his enterprises; but the fact that he looms as one of the country's big men is due more especially to his high record as an arbitrator of labor disputes. In the past few years he has settled many strikes, among them ones involving the Fore River Government Shipbuilding Co., the Boston Elevated, the Boston and Albany and the Boston and Maine Railroads, and the New England Telephone System. Although he employs fifteen thousand people in his own industry, he has not had a strike during his thirty-five years of business. It is not surprising, therefore, that his services should be much sought after by industries and trade commissions, and that his opinions on labor questions are respected.

Mr. Endicott has been kind enough to write the letter which follows for the benefit of the readers of this paper.

Editor of the TECH ENGINEERING NEWS, Cambridge, Mass.

Sir:

I am quite sure the proposed publication will be of benefit to you all. I think a paper, or a magazine, in any college, or institution, or business corporation is a very wise and beneficial thing to establish. In our own business (where we have from 13,000 to 15,000 hands) the employees themselves edit a magazine, and in that magazine they can put any grievances they have, or any criticisms of any members of the firm; in fact, they are absolutely free in every way. The consequence is they have very few real grievances, because after all, the worst grievances are those that a man thinks about, but doesn't talk about, and they grow very large when they are not put out into the open.

Magazines and papers are full of the subject of Industrial unrest. There are thousands of plans suggested—my own mail is full of all kinds of suggestions, almost all of which are "guaranteed" to stop this labor unrest, which is in such strong evidence throughout the country. I have yet to see any plan that is an absolute cure. Many of them have practical suggestions. There probably is some good in all of them, but I think we must finally come down to the realization, that in order that there shall be no real interruption to business, or disagreements between employer and employee, that the first and most important thing is that absolute confidence be established between each party, meaning of course the employer and his employees. This is an easy thing to say, but perhaps a hard thing to always bring about, but it is the "personal touch" in business that counts. Absent landlordism is a failure in business, as well as everywhere else.

Now, the question is asked "How can the head of a large concern, composed of many different plants, situated in various parts of the country, avoid the absent landlordism?" In other words, how can Judge Gary, President of the Steel Corporation, apply the "personal touch" to a business as large as his? I am glad to take him as an example, because I know he is in favor of doing many things for the benefit of his people, but on reading his articles and speeches, and on studying the Industrial situation in his business, it seems to me that he has overlooked, in some instances at least, what I call the "personal touch."

I am not for a moment attempting to suggest to any man how he shall run his business. Each man has to decide that for himself, but if the President of a Corporation, or the head of a concern, cannot live amongst his help, then he should have, in each plant, an officer or a partner, who has full knowledge of how to deal, and full authority to deal directly with the employees.

This man shall not be obliged to refer questions to the absent landlord. This man would, of course, be held responsible for success or failure in dealing with the employees, and the first, and one of the most important things for this man to do, would be to establish a rule that any employee not satisfied with the decision given him by any foreman, or superintendent, not only had the right, but was urged to come to the resident head of that business. This has a double effect—the employee knows that he can get justice, and the foreman or superintendent knows that the employee can appeal to the resident head if they are unreasonable; therefore, they are very careful to be absolutely just, with the result that very few employees ever feel it necessary to go to the head of the concern.

This rule, or well-known fact, which has always obtained in our own business is, I deem, one of the vital points. Last week while at our plants, I asked my partner, who has had full charge of the labor situation for thirty-five years, how many of our employees came to him personally. Now there are some 15,000, as stated above, and his answer was "not an average of one a week."

My judgment is that the man who deals successfully with his labor must know intimately the sorrows, the joys, the ambitions and the every-day life of the men and women working for him, and if he has it in his heart, the way will be very plain to him how he can establish that confidence between him and his employees, that is so necessary to have. Without this confidence, there is suspicion and criticisms, and in many instances hatred, and nothing but harm ever comes where one side or the other feels that they are being treated unjustly.

There are many, many things that a wise employer ought to do to bring about happiness and contentment among his working partners—working conditions, living and housing conditions, amusements, education, innumerable things not being done in a patronizing way, but being established and conducted just as the head of the concern would like if he were an employee; in other words, put yourself, as far as possible, in the other man's place, and then act accordingly.

You have the privilege, of course, of using this, or any part of this, if you desire.

Wishing your paper all success, I remain,

Yours very truly,

H. B. Endicott

SOME WILD ENGINEERING I HAVE KNOWN.

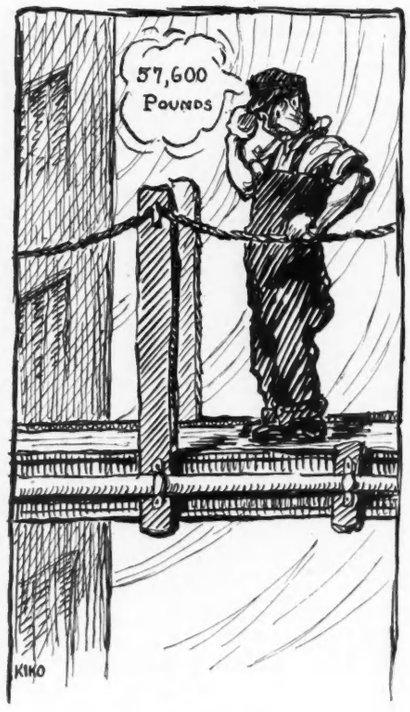
By DAVID WESSON, '83
TECHNICAL MANAGER, SOUTHERN COTTON OIL CO.

Many, if not most, of the troubles in this world come from lack of knowledge of the natural laws and their proper application to practical problems. The theories of practical men are often examples of the old saying that a little knowledge is a dangerous thing. It sometimes leads to wild conclusions, as in the case of the Irish foreman, who was seen thoughtfully studying a light foot-bridge between two buildings about 60 feet apart. Resting on the bridge was a three-inch steam pipe. On being asked what the matter was, the foreman said, "That pipe carries 80 pounds of steam to the inch and 960 pounds to the foot, and the bridge is 60 feet long, and that means 57,600 pounds, and I'm after thinking that must be an awful strong bridge."

The above incident happened before the days of chemical engineering, and the chemist who worked out from his laboratory into the plant had to depend on the mechanical engineer to put his ideas into practice. In those days the mechanical engineer was more likely than not, a man who had graduated from the machine shop and engine room, with a very hazy idea of physics, but a strong reliance on his practical experience and ability to guess. When such a man and a chemist started to design a plant it was often a case of the blind leading the blind, and things were created which sometimes worked and sometimes did not. Difficulties arising from such causes naturally set the scientific minds of the chemists to looking into the causes, and after a proper diagnosis it was comparatively easy for the chemist to design what was needed and let the mechanic do the actual constructive work. This, in the writer's opinion, was the Genesis of the Chemical Engineer.

The writer had the privilege in 1887 of visiting most of the pioneer cotton oil refineries of the country. They were built by mechanics, not chemists, and varied greatly in design and construction. One plant was equipped with cylindrical tanks with flat bottoms and agitated with paddles revolving on a horizontal axis passing through the walls of the tank. The soap stock formed in the process of refining was drawn off as much as possible from the flat bottom, after each refining, and what was left went into the next batch.

Another refinery showed with pride, a large tank made to refine 400 barrels at one batch, but they never worked it more than half full, because the heating



coil was too small to heat the oil rapidly enough, though sufficiently large to condense all the steam from the entire boiler plant.

Some years after this the writer was called upon to design a refinery for the same company. The chief engineer boasted a U. S. license to preside over the engine-room of a tugboat, and knew it all. He was given the design, and when the construction was finished, the writer visited the plant to start it. He found all the valves, and cocks controlling the pipe lines so placed that the pump man would have to spend most of his time on a ladder to get at them, but the most remarkable thing was the installation of a tubular feed-water heater of 250 h.p. capacity installed for cooling hot deodorized oil. That engineer could not get it through his head that this was not big enough to cool down 20,000 pounds of oil from 300 degrees F. to 100 degrees in an hour's time. He knew that the heating tanks contained about 500 square feet of heating surface in the form of coil, while the feed water heater had about 80 square feet. Of course a trial convinced him, and the day was saved by making water connections with the heating coils and cooling the oil right in the tank instead of pumping it through a cooling coil. The same engineer failed to provide a water trap in the steam line carrying open steam to the deodorizer, and one fine day a slug of water was carried into the hot oil and the contents of the tank were blown up the steam outlet pipe and distributed over the neighborhood as a rain of oil in which the observers saw a most marvelous rainbow caused by the rays of the setting sun impinging on the highly refractive droplets.

In running pipe lines funny things happen some times. I remember seeing in a certain plant in Germany, a pipe bent on a beautiful curve on a three-foot radius and connected into the sharpest kind of a right angled elbow at one end of the bend.

In a plant at Memphis some years ago a filter press was located in the top of a refinery, and the four-inch pipe line to carry off the filtered oil to some storage tanks 100 feet distant was run by the engineer in charge, with a four-foot drop straight to the storage tanks. When the filter pump was started up, the pipe line was found too small to carry off the oil and the pan overflowed. Of course the plant was practically tied up till a chemist came along and ordered the pipe line dropped to a nearly horizontal position and then dropping into it with a three-foot vertical pipe from the filter trough.

In the first case a straight line through the shortest distance between two plants did not have more than a six-inch of head to force the oil through it, while in the second case there was a little over three feet of head and the oil ran off freely.

Engineers who should know better will design large tanks to be heated by steam jackets instead of suitable coils. They do not realize that it is impossible to get sufficient heating surface in jackets, nor do they consider the danger in working with jackets at high pressure.

A mistake frequently observed is the designing of tanks to be used under vacuum of too light materials, with the result that they naturally collapse when put in use.

All of us looking through our experiences can think of many other examples of wild engineering leading to more or less disastrous results. The foregoing cases are sufficient to illustrate the ease with which people who should know better are apt to transgress physical laws, which are capable of demonstration. The results, while bad enough, are infinitesimal as compared with those

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THE PREVENTION AND CURE OF THE RED WATER PLAGUE.

By WILLIAM H. WALKER, Ph. D., Eng. D.

DIRECTOR OF THE DIVISION OF INDUSTRIAL CO-OPERATION AND RESEARCH, M. I. T.

People who live in districts supplied with soft water, such for example, as the New England States and New York City, are familiar with what has been termed the "red water plague." This condition of the water is caused by the presence in it of hydrous red oxide of iron commonly spoken of as rust. The fact that this oxide of iron is present in the water means that the iron pipes of the hot water supply system have been correspondingly corroded by the water, and have been pitted or otherwise weakened in proportion to the amount of iron removed. Thus the iron is taken from where it is needed, namely the walls of the pipes, and placed in an objectionable form, where it is not wanted, namely in the water. Many factors incident to modern city life have united in greatly increasing the daily consumption of hot water, and the loss due to failure of pipe lines through clogging by deposited rust, as well as leaks due to pitting, has now become a most important problem.

A great deal of very valuable research has been devoted to the causes of the corrosion of iron, notably by the Massachusetts Institute of Technology, and the seed sown by the early investigators is now beginning to bear fruit. It was for many years thought that rust was formed by the direct union of the oxygen of the air, water and iron. Now we know that such is not the case. In order to form rust, the iron must actually go into solution in the water; if oxygen is present, it later unites with this dissolved iron separating as red rust. The formation of rust by the oxygen is thus the result of, not the cause of the solution of the iron and its resultant corrosion. But careful study showed that the oxygen, which is normally dissolved in all water, plays a more direct and controlling part in this corrosion. Where iron dissolves in water, an equivalent or corresponding amount of hydrogen is set free from the water in the form of gas. This hydrogen covers the surface of the iron and protects it from further attack. But if oxygen be present, it unites with this hydrogen, destroys the protective covering and allows the solution of the iron to proceed. Speaking electro-chemically the hydrogen polarizes the surface of the iron, and the dissolved oxygen acts as a depolarizer. Where there is a complete absence of oxygen in a system, no appreciable corrosion of the iron will take place.

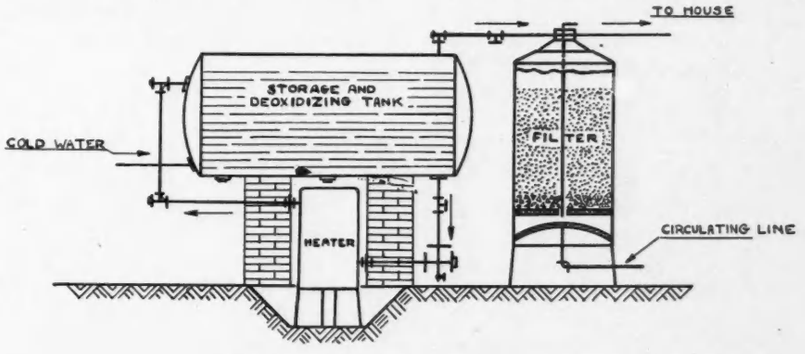
The action of all the factors causing corrosion is greatly accelerated by rise in temperature. Hence a hot water supply system in which fresh, (that is water fully charged with atmospheric oxygen) hot water is constantly passing through, is a most vulnerable structure. But since oxygen is consumed in the process of corroding iron and forming rust, it is obvious that if the water be held in contact with an iron surface it will soon lose all its dissolved oxygen and become inactive so far as further corrosion is concerned. Careful experiments have established the fact that the amount of corrosion, other factors being the same, is directly proportioned to the free oxygen content of the water.

This is now accomplished upon a commercial scale by an apparatus called a "deactivator." The water from the street main first passes through a vessel filled with steam pipes for heating and a large number of iron sheets chemically treated so that rapid corrosion of their surface takes place. The oxygen is promptly consumed by corroding these cheap and easily replaceable sheets, instead of the expensive and difficultly replaceable piping system. The hot water, now free from oxygen, but carrying some of the suspended iron rust, passes through a filter where all floating particles are removed, and a clear pipe water delivered. This water is now deactivated and can be sent through the supply system without injury to the pipes, or inconvenience to the consumer.

In the plant in Pittsburg, where this process was first tried on a large scale nearly four years ago, some pipe was placed in the outlet from the deactivator. No corrosion has been found so far, and the trouble with the old piping in this building has apparently ceased. The metal used to unite the oxygen in the water is of course of the cheapest form and easily replaced. In one plant installed for experimental purposes in an apartment house in Boston the sheets were removed after two years' service, and showed a loss of 25% in weight, due to rusting. But no trouble with the piping has developed during that time and experience indicates that none is to be expected, so long as this treatment continues.

A detailed description of this process and the two plants referred to above will be found in a paper on **The Preservation of Hot Water Supply Pipe in Theory and Practice**, by Apeller and Knowland, **Trans. American Society of Heating and Ventilating Engineers, 1918.**

The advantages of this system are that the deactivation of the water by removal of free oxygen is automatic and does not change the quality of the water for domestic purposes. No attention is required other than the ordinary removal of the accumulated hydroxide of iron from the filter by periodic reversal of the flow at regular intervals.



SKETCH OF DEOXIDIZING SYSTEM

Wild Engineering I Have Known.

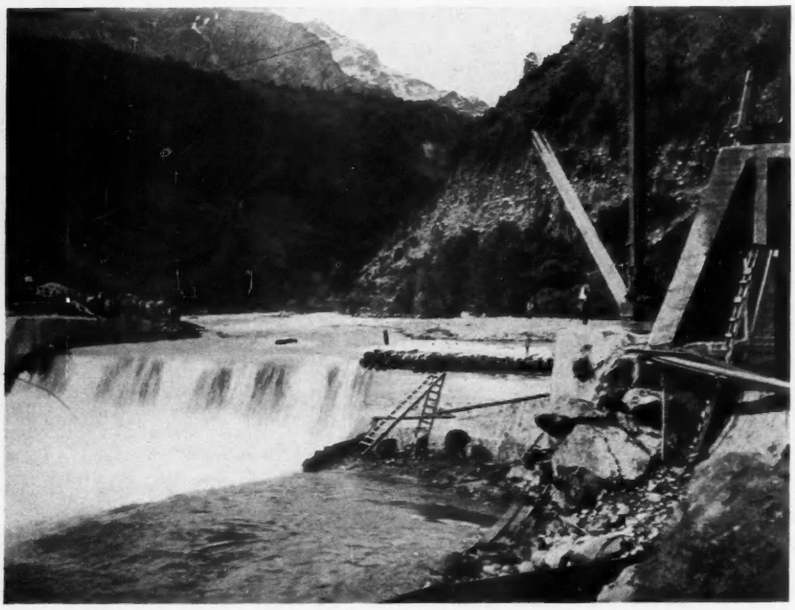
(*Continued from page six*)

obtained by some of our elected statesmen who often from ignorance and often for the sake of votes, take great liberty with social and economical laws and commit social and economical engineering atrocities. The law of supply and demand, for example, is as immutable as the law of gravitation, but how often have we seen it defied by government. We can hold back the flood of a watercourse for a time by constructing a suitable dam, but sooner or later, if the water supplies keep increasing, the dam will either overflow or be carried away and destruction will result.

POSSIBILITIES FOR CIVIL ENGINEERS IN SOUTH AMERICA.

By LOUIS K. ROURKE, '95

The South American continent is very rich in natural resources, the development of which has been scarcely commenced. There is a crying need for high-ways, railways, port works, sanitary works, and the opening up of the enormous mineral deposits of the west coast. Heretofore, what little development has taken place, has been accomplished chiefly by European capitalists and engineers.



THE CACHAPOAL RIVER, CHILE

Because of the Great War, conditions have so changed, that for some years at least, South America must look to the United States to finance her construction projects.

The various South American countries are in good condition financially and their governments are becoming more stabilized, so that there is no doubt but what United States capital will be attracted to this very fertile field. This will mean that United States materials will be used and will be installed by United States engineers.

In our past dealings with the South Americans, which have been comparatively small, we have not succeeded very well in securing their confidence and regard. This result is due, in some instances, to financial trickery but chiefly to the attitude of the North American towards the South American.

The majority of North Americans look on the South American as of an inferior race and treat him accordingly, while the European treats him as an equal and tries to look at things from his point of view.

The governing classes of South America, although of a race somewhat mixed, are filled with an overwhelming amount of Spanish pride and will not tolerate patronizing treatment from anyone; therefore if we are to make a success of our work in South America we must adopt the European attitude towards the South American. The young engineer who proposes to go to South America should have plenty of backbone to resist the numerous temptations which will surround him; he should have a working knowledge of the Spanish language, and be prepared to undergo many hardships due to climatic conditions, lack of congenial society and the comforts of home.

In conclusion, the possibilities for civil engineers in South America are very great indeed; the result will depend on the honesty, skill and tact of the men who undertake the work.

Editor's Note:

With the narrowing field for new enterprise in this country, engineers are more and more turning to foreign countries to exercise their talents. South America with its enormous natural resources, great wealth and pressing need of engineering improvements, is one of the most attractive fields for the exercise of the engineer's ingenuity. Shortening distances through quicker travel and perfected trade routes are making our South American neighbor still more important to us. We are very fortunate in having the benefit of Mr. Rourke's 20 years' experience in South America in the article preceding which he has been kind enough to write for the undergraduates of the Massachusetts Institute of Technology.

Mr. Louis K. Rourke is a graduate of course I, of the class of 1895. Two years after graduating he went to Panama as Road Master of the Panama Railway, during the real yellow fever days. From there, in 1899, he went to Ecuador as Superintendent of Construction of the Guayaquil and Quito Railway, which connects the wealthy port of Guayaquil and the capital Quito, highest capital in the world.

In 1905 Mr. Rourke returned to Panama, and for the next four and one-half years was engaged in the construction of the Culebra Cut. In 1910 he was appointed Commissioner of Public Works for Massachusetts. Upon completion of his term of office in 1915, he opened an office in Boston as consulting engineer and became connected with the Guggenheim interests in Chile. Mr. Rourke has just returned to Boston from Chile, after having spent more than three years at Chuquicamata, where the Guggenheim interests own the largest low grade copper deposit in the world.

We hope to be able to publish in following issues, articles by Mr. Rourke, describing features of interest to engineers concerning the copper mines at Chuquicamata and the Guayaquil and Quito Railway.

Engineers Must Register in Oregon

After the first of the year a person who practices any branch of engineering, except military, in the state of Oregon, must be examined and registered by the newly created board of engineering examiners. Engineering graduates of approved schools may take the examination for a certificate if they have had two years' experience in engineering work, and have had charge of such work as chief or assistant for at least a year. For non-graduates, the requirements are six years of work and one year in responsible charge. United States military and naval engineers, however, are eligible to registration without examination within one year after their honorable discharge from service.

KNOWLEDGE FOR SERVICE.

By HERVEY WOODBURN SHIMER, Ph. D.

We as scientists, or as technologists using science, know that two plus two always equals four, hydrogen and oxygen under certain conditions and with certain proportions always produce water. We have risen superior to much in nature and are rapidly becoming masters over much else, so that we have learned the lesson that knowledge is power. But in our rush to attain this power we are too apt to neglect the historical aspect of the science and as a consequence waste much time experimenting upon propositions which earlier workers have already shown to be false, or arriving at conclusions which knowledge of the past would show us to be unjustified.

So has come about the modern tendency of looking at our work from the standpoint of its development, of its evolution from the earliest conceived conditions. Thus we study in turn the evolution of the elements, the evolution of the stars, including our earth, the evolution of continents and ocean basins, the evolution of the life upon the earth, the evolution of man and all with which he has anything to do, as civilization, arts and sciences. It may be added parenthetically that our knowledge of evolution as the road over which has come into existence all forms does not preclude the philosophical possibility of deity as first cause, the decreer of natural laws and as a persistent vivifying influence.

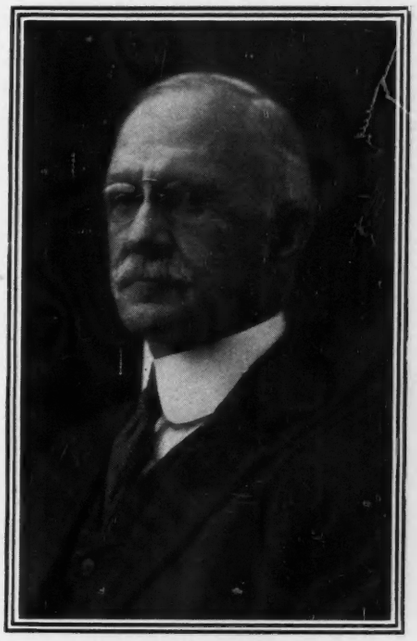
The majority of us feel intuitively that the power which our knowledge gives us is morally legitimate only if used in service to others. Here we find recognition of a fundamental natural law. Searching for the roots of this law in the records of the distant past of life's existence upon earth it is encouraging to read that even the law of self-preservation has no more historical respectability than has this law of service. It is clearly to be seen that if at any time in the past all acts of service had ceased all of earth's life—plant and animal—would have become extinct within a generation. It is only through the sacrifice of some strength of the parent tree that seeds are produced which give rise to the next generation, as it is only through some sacrifice that animals produce their kind. True—this service is at first compulsory, but the slow beginnings of voluntary service among the higher animals can be as clearly traced.

As we thus glance through the history of life upon earth we note that life began its existence lowly in kind; but, still with the compelling instinct to serve its offspring. As time passed, higher and ever higher organisms came into existence, and always with increased ability an increase of service was demanded. Or rather those individual young who received more care from their parents could succeed better in whatever stage of evolution they were, and could thus give more inheritance, in strength and in care to their offspring. Later a few animals possessing a high type of compulsory service began to learn this ages-long lesson of service and performed some acts beyond what was demanded of them. The offspring of these thus had more in inheritance, in strength and in care to give their young. These in turn continued giving voluntarily more and more until we have the highest types of mankind today. Thus the forefront of evolving life was always composed of those individuals who gave more than they received, otherwise there could have been no advance. And that individual who would retain this enviable position must continue giving more in sympathy and in aid than he has received. This law is as true of nations as of individuals.

EDITOR'S NOTE:—We hope to be able to publish other articles by Professor Shimer treating the duties of the engineer from a philosophical standpoint.

Fred J. Miller Made President of A. S. M. E.

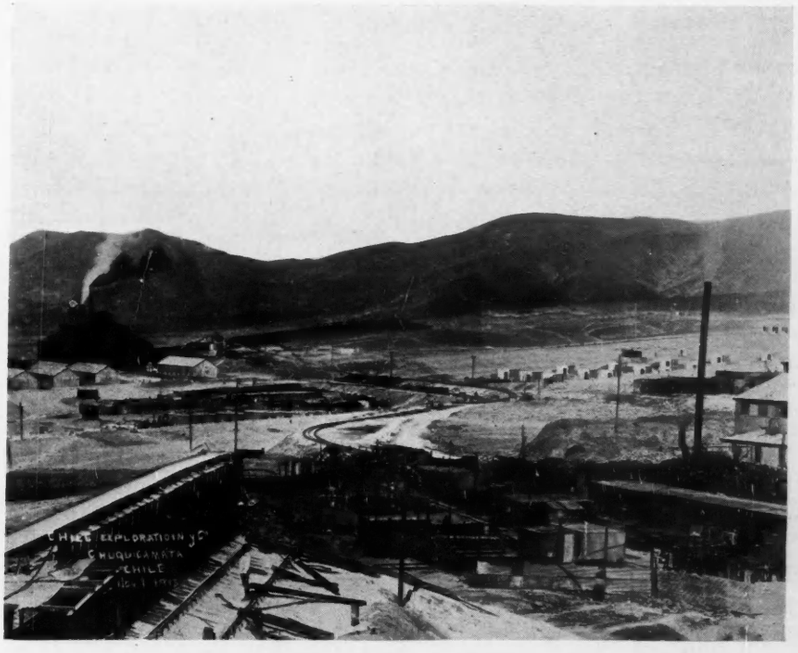
Announcement of the election of Mr. Fred J. Miller to the presidency of the American Society of Mechanical Engineers for the coming year was made at the annual meeting held in New York, Dec. 2 to 5.



Courtesy of The Iron Age

MR. FRED J. MILLER

The new president was born in Ohio in 1857. He became a contributor to mechanical journals and finally a member of the editorial staff of the AMERICAN MACHINIST, where he remained for 20 years, the last 10 years as editor-in-chief and vice-president of the company. Since retiring from journalism, Mr. Miller has been active in commercial enterprises and government service, and is now a member of the Technical Advisory Committee of the War Claims Board at Washington.



REDUCTION WORKS, CHUQUICAMATA COPPER MINES, CHILE

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To be admitted to the Institute, the applicant must have attained the age of seventeen years and must pass examinations in Algebra, Plane and Solid Geometry, Physics, History of the United States (or Ancient History), Trigonometry, English, French and German. Preparation in two of a series of elective subjects is also required. A division of these examinations between different examination periods is allowed. In general, a faithful student who has passed creditably through a good high school, having two years' study of French and German (or three years of French or German) should be able to pass the Institute examinations.

Graduates of colleges, and in general all applicants presenting certificates representing work done at other colleges, are excused from the usual entrance examinations and from any subjects already satisfactorily completed. Records of the College Entrance Examination Board, which holds examinations at many points throughout the country and in Europe, are also accepted for admission to the Institute.

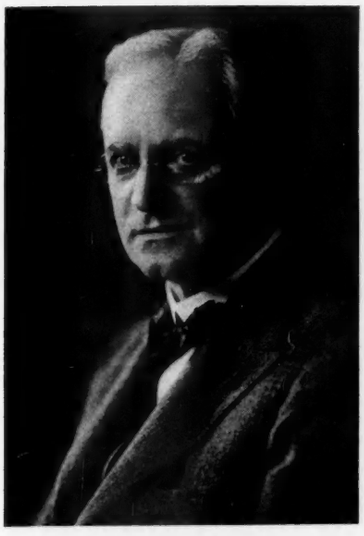
Instruction is given by means of lectures and recitations, in connection with appropriate work in the laboratory, drawing-room or field. To this end, extensive laboratories of Chemistry, Physics, Biology, Mining, Mechanical Engineering, Applied Mechanics, and the Mechanic Arts have been thoroughly equipped, and unusual opportunities for field-work and for the examination of existing structures and industries have been secured. So far as is practicable, instruction is given personally to small sections rather than by lectures to large bodies of students.

The regular courses are of four years' duration, and lead to the degree of Bachelor of Science. In most courses the work may also be distributed over five years by students who prefer to do so. Special students are admitted to work for which they are qualified; and the degree of Master of Science, Doctor of Philosophy, and Doctor of Science are given for resident study subsequent to graduation. Opportunity for research is offered in all the departmental laboratories, in the three recently established Research Laboratories of Applied Chemistry and Physical Chemistry, and in the Sanitary Research Laboratory and Sewerage Experiment Station.

The tuition fee, not including breakage in the laboratories, is $250 a year ($300 next year and thereafter). In addition, $40 to $50 per year is required for books and drawing materials.

For catalogues and information, address

PROFESSOR ALLYNE L. MERRILL, Secretary of the Faculty,
Massachusetts Institute of Technology,
CAMBRIDGE, MASS.



MR. GEORGE EASTMAN

An American Source of Organic Chemicals for Research.

(*Continued from page one*)

During the war the chemical industry of the United States grew to an enormous extent, and the technical laboratories which fed it were correspondingly developed, but both these and the university laboratories were soon hampered by the lack of satisfactory supply of research chemicals, and whenever a piece of work was undertaken, it was necessary to delay it until the necessary raw materials for the research had been prepared in the laboratory itself—often in a series of steps involving much loss of time and great cost. Some of the universities organized their resources to prepare the materials required by the work of students and instructors, but this only partially met the question, and since it was clear that the supply of synthetic organic chemicals was a "key" section of the chemical industry, it became urgently necessary for an industrial firm capable of carrying the work through to undertake the purchase, purification, and distribution of intermediates from the various works that made them together with the synthesis of other materials required for research work but not manufactured on a large scale.

The difficulties of the undertaking were obvious and considerable. There could be no prospect of financial profit, at any rate for many years. The preparation of a large number of pure chemicals on a small scale involves very high costs, inevitably much higher than those obtaining in Germany before the war. Many of the intermediates necessary for the work were, owing to the great demand, expensive and in some cases unobtainable, while the work requires trained chemists of high caliber who at the time were not available. It was clear that success could be obtained only if the experiments were undertaken by a first-class firm, as a patriotic duty rather than for any pecuniary return; and after consideration the Eastman Kodak Company decided to take up the matter in order to supply the link missing in the chain of production of the American chemical industry. The offer of the company was received with enthusiasm by the American Chemical Society, the industrial and organic sections of which at once promised their support, and the undertaking has from the beginning received the cordial support of the American manufacturers who have supplied intermediates for the work which they were not willing to place on the open market and in certain instances have made special runs of materials not otherwise obtainable.

From the beginning, orders were received more rapidly than materials could be produced, and naturally the range of synthetic products required was far greater than could be placed on the market at one time, but the number of chemicals supplied has grown rapidly until at present there are available 623 chemicals, of which 422 are made in the Research Laboratory of the Eastman Kodak Company itself, and the work is now approaching the stage where the greater part of the orders received can be filled from stock. Financially, the undertaking up to date has been at least as costly as was expected, the loss on the first year's working exceeding $14,000. The investment in the stock is very considerable. The large number of chemicals held in stock and the considerable average value which they present make a heavy investment necessary. The main cost is in the labor used for the preparations and is due primarily to the small scale on which the materials must be made as well as the experimental work which is necessary in order to add new preparations. The company, however, believes that with the support of the American chemists a success can be made of the undertaking, and provided the American universities continue to purchase chemical supplies manufactured in this country, the United States will finally secure a home supply of chemicals which will be available at once and at prices comparable with those at which they can be purchased anywhere in the world.

THE SCIENTIFIC DEVELOPMENT OF THE STEAM LOCOMOTIVE.

By H. F. HEDBURG, '20

It is not surprising that students of mechanical engineering should regard the locomotive as a finished product, and any further increase in the efficiency as being out of the question. It is one of the oldest and most used of our modern machines, and the best engineers throughout the country have worked for generations to perfect it.

That this surmise is false, and that there is room for great improvement in the design of the locomotive is conclusively demonstrated in the address of the title above, given before the American Society of Mechanical Engineers by John E. Muhlfeld in December, 1919, of which the following is an abstract. Copies of the complete address may be obtained gratis upon application to the American Society of Mechanical Engineers.

In this country the steam locomotive has never been classified as a refined mechanism, largely because of the indifferent conditions under which it must be operated and maintained. Nevertheless, there has been marked progress

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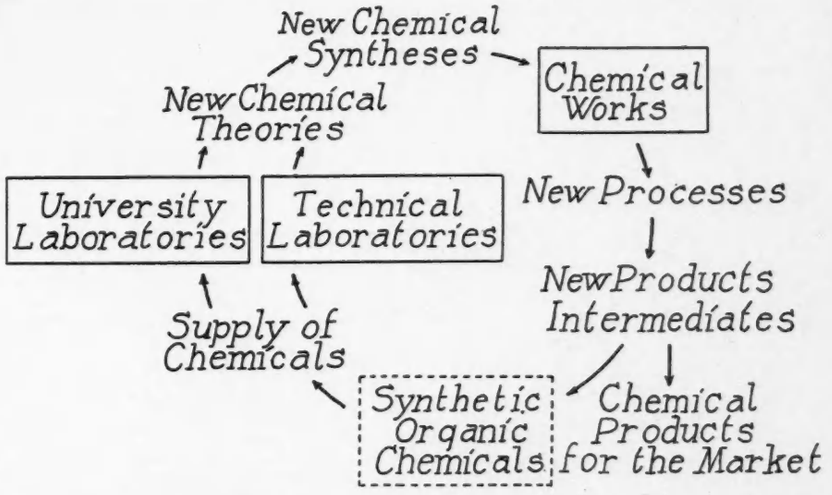


ALUMNI COLUMN

Readers are requested to forward to the editors all matters of interest which may come to their attention regarding members of the alumni.
Address all communications to Alumni Editor THE TECH ENGINEERING NEWS, Cambridge, Mass.

W. W. Stevens, '98, who was for some years manager of the construction and manufacturing department of the Standard Oil Company of New York in their North China territory, is now associated with the Texas Co. in New York in the capacity of superintendent of the terminal and equipment division of the export department, which has charge of all construction work in foreign territories; and also as superintendent of the fuel oil division of the export department, which has charge of all export marketing of fuel oils. He has associated with him W. E. Booth, '08, formerly electrical engineer with the Western Electric Company and Allen F. Brewer, '13, Ensign United States Naval Reserve Force, who served in the capacity of warrant machinist on board the oil tankship U. S. S. "Edward L. Doheny, 3d."

George Lawrence Smith, '98, having completed his work on the Boston army supply base, on which project he had charge, for the designing and supervising engineers, of the architectural work on all the buildings, announces his return to private practice at 15 Beacon Street, Boston, where he is associated with Fay, Spofford, & Thorndike, Consulting Engineers.

W. M. Corse, '99, has resigned his position as technical superintendent of The Ohio Brass Company, Mansfield, O., and accepted a position as General Manager of the Monel Metal Products Corporation of Bayonne, N. J.

Elbert G. Allen, '00, has been appointed advisory engineer of the Stone and Webster oragnization. He received the degree of B.S. in M.E. in 1900 and E.E. in 1901. From 1901 to 1907 he was employed on various kinds of engineering work. He was superintendent of construction for Stone & Webster at Dallas, Texas, in 1907 and then returned to the Boston office where has has since had charge of much of the steam and electrical work done by the company. In 1918 he was made Assistant Engineering Manager. His new appointment as advisory engineer will leave him free from routine matter so that he can devote himself to consultation and special problems.

H. O. Stewart, '09, who has been connected with the Rochester Light and Railway Co. as engineer in the industrial department, has recently become production manager of Max Lowenthal & Sons of Rochester, N. Y. In his new position Mr. Stewart will make a complete survey of the motors of the plant with a view to obtaining efficient operation. Mr. Stewart was graduated from M. I. T. in 1909 after completion of a scientific course at the University of Rochester in 1907.

Harry D. Peck, II, '13, head of the machinery department of the United Shoe Machinery Company, has accepted a position as superintendent of the Messberg Steel Corporation of Attleboro and will begin his duties there next week. Although a young man, Mr. Peck is one of the best known men employed by the company. He began work for the company when he was sent to South America. He went to San Paulo, Rio Janeiro and Buenos Ayres. Returning to this country he attended Chauncy Hall School, Boston, where he took a course of study to fit him for the Massachusetts Institute of Technology. He also took a course at Bryant & Stratton, Boston. He was graduated from the Institute in 1913 with the degree of Mechanical Engineer, after which he was employed by the Bemis Bag Company of St. Louis, serving as traveling auditor.

Mr. Peck traveled all over the country from Boston to San Francisco and from Winnipeg to New Orleans while employed by the company. He then became head of the accounting department of the United Shoe Machinery Company and was soon promoted to the head of the store and stock department. He entered the aviation service of the United States army July, 1917, as lieutenant and came home a captain at the close of the war. Re-entering the employ of the United Shoe Machinery Company, he was placed in charge of the machinery department.

A. F. Graham, Jr., '14, is with the Dodge Engineering Co. at South Boston as a mechanical engineer of tractors. During the war he was assistant secretary and traffic manager of the Sturtevant Aeroplane Co. at Jamaica Plain, Mass.

The Scientific Development of the Steam Locomotive.

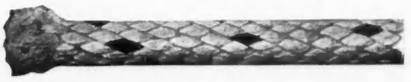
(Continued from page eleven)

in its development due to superior engineering ability, but this progress has been confined largely to increases in weight, size and hauling power; and although much has been also gained by the introduction of superheaters and fire box baffle walls, there is still unlimited opportunity for further improvements in thermal and machine efficiency, and in reducing smoke, cinders, gases and noise.

The desiderata of a steam locomotive may be summed up as follows: A reasonable first cost; maximum capacity for service within roadway weight, curvature, and clearance requirements;

(Continued on page thirteen)

SAMSON SPOT SASH CORD



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The Scientific Development of the Steam Locomotive.

(*Continued from page twelve*)

ability to handle the heaviest gross tonnage practicable at the highest permissible speed; positive control of mechanical operation; economy as regards fuel and water consumption and repairs; minimum manual labor for terminal and road handling; construction of the least number of parts, and capacity to perform continuous mileage without failure.

In the case of the locomotive, as well as with almost any other mechanism, a surprisingly large number of conditions must be considered in determining the most effective and most economical design. A few of these factors will be mentioned here very briefly.

In order to improve tractive power it would be desirable to curtail the use of trailer wheels and four-wheel leading trucks, thereby placing greater weight on the driving wheels and increasing the adhesive power. Furthermore, on account of increased length, higher center of gravity, extended front and back overhang, and increased forces due to reciprocating parts, it is necessary to overcome many difficulties in order to maintain proper tracking, curving and riding qualities.

An item of tremendous importance is that of obtaining a supply of boiler feedwater not containing excessive incrusting, corrosive and foaming elements. Incrustation, corrosion, leakage and burning, resulting from impure water, cause delays and heavy costs for cleaning, repairing and extra fuel consumed, and such water should always be given proper mechanical or chemical treatment for purification.

With the cost of locomotive fuel practically doubled in the last two years, it is very important to use proper fuel, and for coal-burning locomotives, it is found that soft coals should never be used when gas coals are available, the increased cost from the use of the poorest coal, being as high as 43 per cent. In the past 65 years very little has been done to improve the fuel combustion, and it is said that from 25 to 50 per cent. of the available energy in the fuel is needlessly wasted. The factors affecting the economical combustion of fuel are: grate and draft; amount of heat carried off in stack gases, sparks and cinders; combustible in the ash; unabsorbed heat in the vapors of combustion; hand and mechanical firing; firebox and combustion chamber volume; arrangement of heat-absorbing and-radiating walls etc., all of which should be studied scientifically with a view to better performance.

Attention must also be given to the effect of radiation, conduction and connection of heat, both between surfaces and bodies within the locomotive, and from the outside surface to the atmosphere.

It is important that the boiler water circulation be quite rapid, and that there be no choked pockets. Furthermore the present day locomotive often sends wet steam to the superheater, thus decreasing its efficiency. It is recommended that something be done to improve this condition and also that higher steam pressures be used, 350 pound pressure in combination with 300 deg. Fahr. of superheat being considered not excessive. Superheating has done more to increase hauling power and thermal efficiency and to reduce fuel and water consumption than any other one thing ever introduced into locomotive design. By its use the drawbar pull has been increased from 15 per cent. at 20 miles per hour to 40 per cent. at 50 miles per hour, making it possible to haul much heavier trains.

Besides the above considerations there are many others which deserve careful study, and there are many ways in which the locomotive can be improved, as a result of such study. Among these considerations are: The effect of compounding; valve gears; cylinder clearances and back pressure; valves; use of

(*Continued on page fourteen*)

THE
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The Scientific Development of the Steam Locomotive.

(*Continued from page thirteen*)

otherwise waste heat in exhaust steam heaters and flue-gas economizers; effect of friction and resistance of all kinds, internal and external; acceleration; deceleration; lubrication, and special appliances, such as heating, lighting and braking accessories. All of the above factors must be studied carefully in their relation to the effective and economical operation of locomotives, and the design, construction and equipment of locomotives must now be placed on a high engineering basis rather than on a basis of purchasing price in conformity with other high class machinery.

Starts 4,000-Mile Air Trip

In a single-seater touring airplane built by the Farman Brothers, the French aviator, Boussotrot, has set out on a 4,000-mile aerial touring expedition through Paris, Madrid, Gibraltar, and Morocco. The object of this journey is to prove that touring by airplane is a practical and economical proposition. The Frenchman has set out alone without making any special arrangements in advance for supplies or landing fields, and at the end of his trip he will publish a detailed account of his expenses.

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CURRENT ARTICLES OF INTEREST

A list is given below of articles appearing in current numbers of various periodicals which the editors believe would be to the interest of men in the different courses. When not specified otherwise, magazines in which these articles appear will be found in the Central Library.

COURSE I.

Interesting Mode of Sealing Up Blow-Out in Concrete Dam. ELECTRICAL REVIEW, November 29, 1919, p. 918. A short article, with illustrations, that should prove interesting to Juniors and Seniors. Vail Library.

Laboratory Tests on a New Spike. RAILWAY MAINTENANCE ENGINEER, December, 1919, p. 448. An interesting study of the respective values of track spikes. Library, Rm. 1-290.

Steel in Concrete Construction in Sea Water. J. L. Harrison. CONCRETE, December, 1919, pp. 236-39. A discussion of the effects of sea water on reinforced concrete. Library, Rm. 1-290.

Study of Pressures in Hydraulic Dam Cores. ENGINEERING NEWS-RECORD, December 25, 1919, pp. 1040-44. A rather advanced article, dealing with the methods of Miami Conservancy Engineers to obtain data on core constistency and action. Library, Rm. 1-290.

Resevoir Floor Partly Supported by Concrete Arches. ENGINEERING NEWS-RECORD, December 25, 1919, p. 1062.

COURSE II.

New Sources of Energy. Robert Everett. THE NATION'S BUSINESS, December, 1919, p. 32. A study of colloidal fuel. Library, 1-290.

The Cylinder Lock. Ellsworth Sheldon. AMERICAN MACHINIST, December 11, 1919, p. 979.

Some Considerations of Oil Fuel for Boilers. POWER, October 25, 1919, p. 740.

COURSE III.

What Shall We Do For Oil? POPULAR SCIENCE MONTHLY, December, 1919. An interesting, easily read, article raising a number of queries on the future of petroleum.

Mining Methods and Tunneling the Front. THE CANADIAN ENGINEER, December 25, 1919, pp. 555-57. An article by a Canadian captain, describing some of the methods used during the war in tunnelling.

COURSE VI.

Applicability of Automatic Switching to All Classes of Telephone Service. Arthur Bessey Smith. PROCEEDINGS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. 38, No. 12, pp. 1335-1368, December, 1919.

Characteristics of Some Polyphase Transformer Connections. L. F. Blume and A. Boyajian. GENERAL ELECTRIC REVIEW. Vol 22, No. 12, pp. 1035-1043, December, 1919.

Ionic Oscillations in Three-Electrode Thermionic Valves. R. Whiddington. RADIO REVIEW. Vol. 1, No. 2, pp. 53-66, November, 1919.

Long Wave Reception and Elimination of Strays on Ground Wires (Subterranean and Submarine). Lieutenant-Commander A. Hoyt Taylor. PROCEEDINGS OF THE INSTITUTE OF RADIO ENGINEERS. Vol. 7, No. 6, pp. 559-583, December, 1919.

Polar, Multi-exposure, High Speed Camera. J. W. Legg. ELECTRIC JOURNAL. Vol. 16, No. 12, pp. 509-512, December, 1919.

The Searchlight in the U. S. Navy Ralph Kelly. PROCEEDINGS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. 38, No. 12, pp. 1369-1384, December, 1919.

Testing of Transformers by the Alternating Current Potentiometer. Douglas C. Gall. ELECTRICIAN. Vol. 83, No. 2167, pp. 603-604, November 28, 1919.

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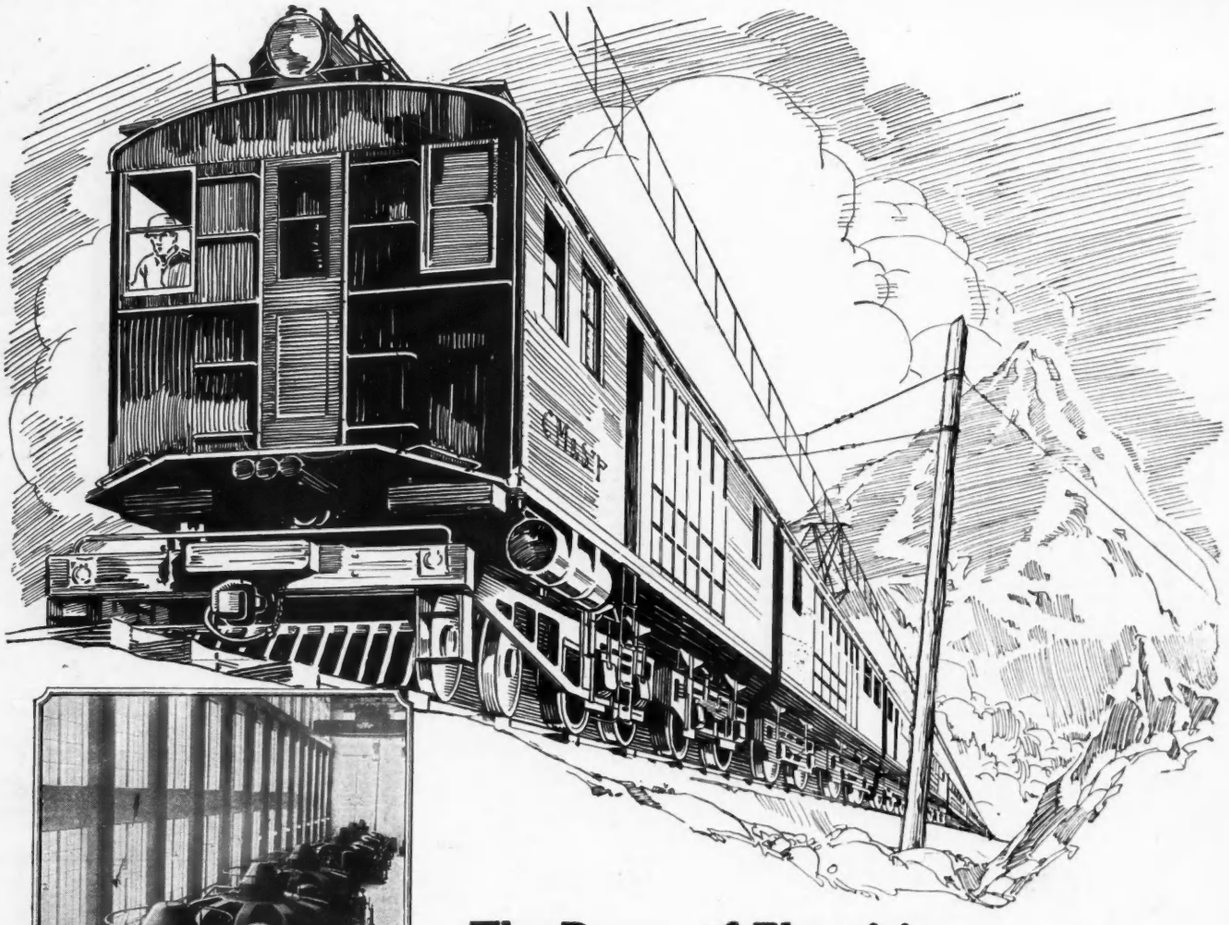

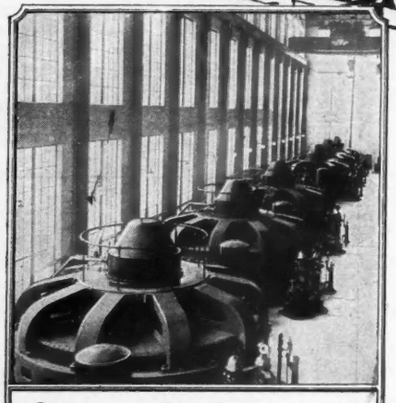

Generator room of one of the hydro-electric plants which supply power to the C. M. & St. P.

Some Advantages of Railroad Electrification

Saving the Nation's coal.

Lower maintenance costs.

Greater reliability and fewer delays.

Ability to haul smoothly heavier trains at higher speeds.

Operation of electric locomotives unaffected by extreme cold.

Ability to brake trains on descending grades by returning power to the trolley.

The Power of Electricity in Transportation

ELECTRICITY has leveled out the Continental Divide. The steam locomotive, marvelous as it is after a century of development, cannot meet all of the present demands for transportation facilities. Its electric rival has proved to be far superior.

On the mountain divisions of the Chicago, Milwaukee & St. Paul Railway—the world's greatest electrification—giant electric locomotives today lift an ever increasing freight tonnage over the mile-high Rockies and also make traveling clean and comfortable. They utilize the abundant energy of distant waterfalls and then, by returning some of this power to the trolley, safely brake the trains on descending grades. And their capabilities are not impaired by excessively cold weather when the steam engine is frozen and helpless.

Electricity is the power which drives the trains of New York City's subway and elevated systems. It operates the locks and tows the ships through the Panama Canal. It propels the Navy's latest super-dreadnaught, the *New Mexico*. Electric mine locomotives have replaced the slow-moving mule and the electric automobile has also come to do an important service. Such achievements were made possible by the extensive research and manufacturing activities of the General Electric Company.

Electricity has become the universal motive power. It has contributed efficiency and comfort to every form of transportation service and in this evolution General Electric apparatus has played a large part—from mighty electric locomotives to the tiny lamp for the automobile.

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